Contribution of Different Feeding Method and Protein Source on Blood Urea as well as Urinal Nitrogen Excretion of Ettawah Crossbreed Goats

by Dian Wahyu Harjanti

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Abstract. Ettawah crossbreed goats are great potential to meet the need of milk in Indonesia. The potency could be optimized by administering good feeding management and high quality feedstuffs, that could be evaluated by urea metabolism and nitrogen balance of animal body. This research is aimed to evaluate effects of feeding method along with protein source. Sixteen ettawah crossbreed goats were administered with iso crude protein (17%) and total digestible nutrients (68%). Factorial design was applied which the factors were feeding method (Total Mixed Rations/TMR vs. Separated/SEP) and protein source (soybean meal/SBM vs. Fish meal/FSM), therefore four treatments were administered (T1:SEP+SBM; T2:TMR+SBM; T3:SEP+FSM; T4:TMR+FSM) for 3 weeks and data collecting on 4th week. Concentrates (50%) were given at the beginning then Napier grass hay (50%) on separated feeding method. Feed, orts, urine, feces and milk were collected for nitrogen quantification, Bloods *from* jungular vein drawn on 0, 3, 6 hours after feeding and milk were collected for urea quatification. The result shown that TMR (T2&T4) significantly ($p<.05$) gave higher 3 hous after feeding blood urea concentration then SEP (T1&T3) (43.84vs40.19mg/dl). There were no significant ($p>0.05$) effect of tretments to milk urea concentration, but all treatments have excess milk urea concentration. Both feeding methodes and protein source significantly ($p<0.01$) affecting urinal nitrogen exctretion, which T2 has the most high nitrogen excretion (3.56g/d). Concluded that TMR as feeding method and FSM as protein source affecting greater nitrogen excretion which implicates inefficiency.

Keywords: total mixed rations, soybean meal, fish meal, blood urea concentration, ettawah goats.

1. Introduction

The concentration of urea in the blood and milk could be an indicator of the process of utilizing the quantity and quality of feed protein. Excess of ammonia which is not synthesized into bacteria, will be converted to urea in the liver [1]. Ammonia is converted to urea through an oxidation process in the

liver. The urea then returned to the rumen through saliva, rumen walls and some is excreted within urine. Urea is very easy to moved from blood into milk when it enters the udder. Urea levels in milk namely Milk Urea Concentration (MUC) which is highly correlated to blood plasma urea [1]. In addition, amino acids that are not utilized in the udder gland will be degraded by process of deamination [2]. High MUC levels can be an indicator of inefficiency of feed utilization in the rumen [3]

Excess urea levels can be overcome by increasing the performance of rumen microbes. The exact ratio between ammonia and VFA and simultaneously available gives the effect of optimal microbial protein synthesis [4]. Improving the quality of feed can be done through the provision of rations with a balanced amino acid content, thus providing an optimal utilization effect in the udder for milk production [5]. Total Mixed Rations (TMR) is one method of feeding which is considered to be able to optimize the utilization of VFA and ammonia in the rumen. Farmers in general still use the method of separate feeding (SEP). The comparison between the two is not widely known in Ettawah Crossbreed goats.

Soy bean meal (SBM) is a source of protein from vegetable while fish meal (FSM) comes from animal. Both are not competitive with humans because it is a by-product processing of major foodstuffs. The problems that arise, because both have different protein quality, so that causing the difference in the use of nitrogen from SBM and FSM. This study is aimed to determine the effect of feeding method and protein source on the appearance of Blood urea concentration, milk urea concentration and nitrogen balance.

2. Methodology

This study were used 16 Ettawah crossbred goats with the same age and average body weight (43.09 ± 0.88kgs; CV 2.04%) and in second lactation with milk production (735.50 ± 65.28g/day; CV 8.88%). These goats were divided into 4 groups that are labeled for 4 treatments. Factorial was used for treatments design with the factors were feeding method (TMR and SEP) as well as protein source (SBM and FSM). Four treatments from these combination factors were T1: SEP + SBM; T2: TMR + SBM; T3: SEP + FSM; T4: TMR + FSM. The diet were iso crude protein 17% and iso total digestible nutrient 68% consisted of napier grass hay and concetrate that have ratio of both were 50:50. The diet composition displayed on **Table 1**.

The diets were administered 3 weeks and the 1 week last was for data collecting. Feeding method TMR (T1 and T3) were technically mixed all concentrates and hay then fed the mixture to goats. Separated (T2 and T4) method was different from TMR because the concentrates was fed first then followed by napier grass hay on the next 3 hours. On the collection time, the feed, orts, urine, milk and feces were collected for nitrogen quantification by Kjeldahl method. Milk and blood from jungular vein on 0, 3, and 6 hours after feeding were collected as well for urea concentration quantification. The data collected then statistically calculated using IBM SPSS 16, the Analysis Of Variance (ANOVA) were conducted then followed with Duncan Multiple Range Test (DMRT) for post hoc as well as orthogonal contrast to determine the difference of feeding method (T1&T3 *vs* T2&T4) and protein source (T1&T2 *vs* T3&T4).

3. Results and Discussion

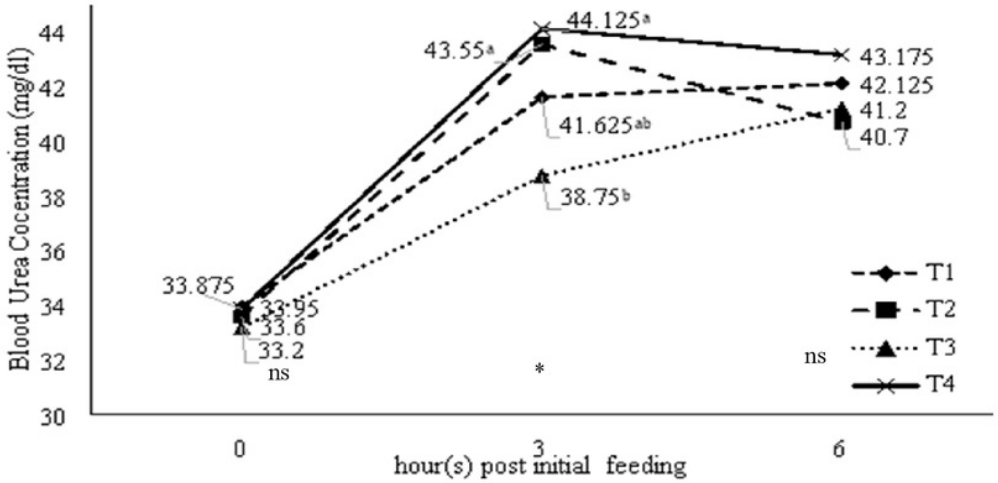
Blood Urea Concentration (BUC)

The results showed that the treatment of feeding had no significant ($p>0.05$) effect to blood urea levels at 0 and 6 hours post initial feeding. This related to the lack of digestion of feed in the rumen at the 0 hour, in other words, 0 hour is an initial feeding time. Blood urea levels at 6 hours post initial feeding which is not significantly related to the process of fermentation of elephant grass was ran after feeding at the 3rd hour. This causes an increase of ammonia production and followed by a tend to increase the blood urea concentration curve. Animals fed by the TMR method had stable blood urea levels until 6 hours after feeding. The SEP method tends to increase the value of BUC due to forage consumption at

3 hours after initial feeding or in other words fermentation substrate was increased on that hour. These results are presented in **Figure 1**.

Table 1. Diet composition and nutrient contents of treatments on 100% dry matter

	Diets	
	T1 and T2	T3 and T4
Feedstuffs		
Napier grass hay (%)	50.00	50.00
Rice hull (%)	6.50	5.04
Soy bean hull (%)	10.00	13.50
Pollard (%)	2.00	13.00
Soy bean meal (%)	8.00	0.96
Coconut meal (%)	18.00	7
Fish meal (%)	-	5.00
Molasses (%)	4.00	4.00
Mineral mix (%)	1.50	1.50
Nutrient content		
Crude protein (%)	17.44	17.17
Ether extract (%)	4.12	2.78
Crude fiber (%)	32.45	33.24
Ash (%)	7.55	7.22
Nitrogen free ectract (%)	36.93	38.08
Total Digestible Nutrients (%)	68.30	69.40
Organic matter (%)	92.45	92.78



Note : *=Significantly different ($p<0.05$) on same hour; ns=Not significantly different ($p>0.05$) on same hour; T1=SEP+SBM; T2=TMR+SBM; T3=SEP+FSM; T4=TMR+FSM.

Figure 1. Blood urea concentration on certain post initial feeding hour

Blood plasma urea levels at the 3 hour after feeding showed a significant effect ($p<0.05$). The highest levels were achieved by treatment with the TMR (T2 and T4) method then followed by SEP (T3 and T1). The contrast test shows that aspects of the feeding method affected these parameters. The 3 hour urea level after feeding was higher in the TMR feeding method than SEP (43.84 vs 40.19 mg / dl). These results are related to the characteristics of feed consumption by animals. It has been explained before that the TMR feeding method can maintain the ratio between napier grass and concentrate rather than SEP. TMR with napier grass and concentrate 50:50 ratio gave a positive impact on nutrient consumption and feed prices, but also increases blood plasma urea levels due to increased forage degradation [5].

Indirectly, the characteristics of the animals on consuming diets are also influenced by feeding method. Technically, feeding in this research was conducted by giving half portion of diets in dry matter, twice a day at the morning and evening. Half the portion is consisted of concentrate and forage. The goats that received SEP treatments will eat the concentrate first until run out before the forage is given, while TMR will eat a portion of mixed feed. It is also known that concentrate in the rumen tends to produce higher VFAs, especially propionic acid, but little part of Non Protein Nitrogen (NPN) and protein are degraded to produce ammonia [6] This also causes blood plasma urea levels of TMR treatment to be higher and then stable, while SEP is relatively lower at the 3 hour after initial feeeing but rised to the 6 hours. Pazzola et al. [3] argues that blood plasma urea levels are affected by the production of ammonia in the rumen where the ammonia is channeled to the liver to be converted into urea through the oxidation process. Ammonia production in the rumen is strongly influenced by the type and quality of feed [7]. Low-quality feed tends to contain more non-protein nitrogen than pure protein, so it is easier to produce ammonia.

Urea levels in the blood are also related to the utilization of amino acids in animal's organs including mammary glands. Metabolism to utilize amino acids into milk protein requires a balance condition in that process. Amino acids will be flown into the Splanchnic network to be catabolized to urea [8]. The urea is then excreted through urine or reentered into the rumen through it is wall and saliva [2].

The value of blood plasma urea levels in this study is considered lower than some existing studies. Blood urea plasma levels in the study of Arieli et al. [9] ranged from 48-54mg/dl and Giaccone et al. [1] with an average of 43.5 mg/dl. There is a mechanism to recycle urea in animal body. The level of urea in the blood itself can be influenced by water consumption and urination factors, so the value obtained in this research, sometimes does not fully describe the process in the animal body.

Milk Urea Concentration

The treatment given for urea levels in milk had no significant effect ($P>0.05$). Urea levels in milk are related to average blood urea levels. Insignificant blood urea levels might also influence milk urea levels [9]. The aspect of feeding method and the source of feed protein do not affect the level of milk urea, although blood urea at the 3rd hour is affected by treatment and flux is present. This can be caused by the process of diffusion of blood urea into milk takes place at any time, while the method of feeding affects blood urea levels at the time of feeding. Blood urea levels are adjusted by the body through urine excretion [10]. Milk urea levels in this study were considered normal when compared with other studies. The results of this study are below the research results of Arieli et al. [9] in the range of 48-56mg / dl and Sahoo and Walli [11] in the range of 54-62mg/dl with relatively identical feed protein levels from this research.

Nitrogen Balance

The results showed that the nitrogen balance was positive but the treatment did not have a significant effect ($p>0.05$) on the amount of nitrogen intake, feces and milk. A significant effect ($p<0.05$) was obtained on the amount of excreted urine nitrogen. These results are appaering due to the method of feeding and providing protein sources aspects. Urine excretion is highest in T2, then T1, T3 and T4 treatments. The TMR method increases the amount of excretion of nitrogen through urine compared to SEP (2.91 vs. 2.30g). Protein sources by soybean meal increase urinary nitrogen excretion than fish meal (3.06 vs 2.15g). This can be related to the utilization of feed protein where the calculation results

show that fish meal has a higher RUP value than soybean meal (data not shown), thereby increasing ammonia production and if not utilized well that will be excreted in urine [12]. The remaining amino acids due to imbalance will be catabolized to urea and excreted in urine [8]. Blood urea levels in T2 and T4 were not significantly different ($p>0.05$) but milk production was different ($p<0.05$) (data not shown). This shows better utilization of nitrogen on animals treated with T4. This opinion is supported by urinary urea excretion data which T2 treatment was higher than T4. The nitrogen balance of each treatment was relatively high, that was related to the crude protein content and quality of the treatment diets. Tahuk et al. [13] argues that high levels of feed protein will increase the nitrogen balance value.

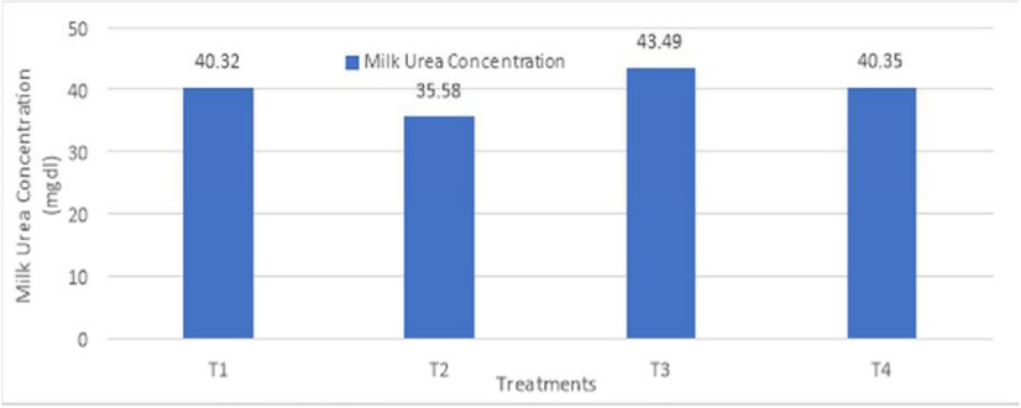


Figure 2. Milk urea concentration from each treatments.

Tabel 2. Nitrogen balance of each treatment

Parameter	Treatments				Contrast test (p value)	
	T1	T2	T3	T4	1-3vs2-4	1-2vs3-4
Total nitrogen intake						
Consumption (g)	19.51	17.13	18.18	20.65	0.98	0.46
Total nitrogen excreted						
Feses (g)	2.59	2.39	2.10	2.26	0.91	0.11
Urine (g)	2.55^{b}	3.56^{a}	2.04^{c}	2.26^{bc}	0.00	0.00
Milk[1] (g)	2.30	2.21	2.41	2.85	0.30	0.04
Nitrogen balance	+12.08	+8.97	+11.63	+13.28	0.56	0.14
Urinal urea (mg/dl)	202.47	182.84	206.36	192.42	0.81	0.92
Sum of urinal urea (g)	3.28	4.36	3.33	2.54	0.79	0.11
Body weight loss (g/day)	34.21^{a}	19.08^{b}	31.58^{a}	13.16^{c}	0.00	0.01

Different superscripts on the same row shows significant differences ($p<0.05$); 1. ANOVA test is not significant; T1=SEP+SBM; T2=TMR+SBM; T3=SEP+FSM; T4=TMR+FSM.

The treatment given influenced the decrease in body weight of livestock during the trial period ($p<0.05$). The contrast test results show that the method of giving PSH decreases body weight greater than TMR (32.89 vs 16.12g/day). Soybean meal protein sources affecting lower body weight of the animals than fish meal (26.60 vs 22.37g/day). Decreasing body weight in dairy animals is related to the body catabolism process to meet milk production needs [9]. This finding shows that, while feed consumption was not significantly different, the use of feed to meet production needs is better in the treatment of TMR feeding method and fish meal as protein source. This opinion is further confirmed that TMR gave better fermentation, resulting in glucogenic fatty acids and a greater contribution of

microbial protein. Diets that include fish meal as it is composition causing more balanced amino acids if consumed by animals [14].

4. Conclusion

Feeding method with TMR tend to produce higher ammonia and then urea excretion, so does FSM as protein source when fed to Ettawah crossbreed goats.

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